

19 November 1957

PROPOSED ADVANCED RECONNAISSANCE SYSTEM

1. Background:

a. The President's Board of Consultants on Foreign Intelligence Activities included in its latest semi-annual report the recommendation "that an early review be made of new developments in advanced reconnaissance systems". In the text of its report, the Board states that it is aware of two proposed reconnaissance systems. It is known informally that this is intended to refer, on the one hand, to the several proposals now under consideration in the Department of Defense for a reconnaissance satellite and, on the other, to a study currently in progress in the Central Intelligence Agency of the feasibility of a manned reconnaissance aircraft designed for greatly reduced radar cross section. This memorandum deals exclusively with the latter of these two proposed systems.

b. The study in question had its origin in the RAINBOW Project, the purpose of which was the development of radar camouflage which would be applicable to the U-2 aircraft without serious impairment of performance and sufficiently effective to permit a small percentage of reconnaissance missions to go undetected and greatly to reduce the accuracy and extent of radar tracking of reconnaissance missions even when detected. Although considerable success has been achieved toward this objective, it began to be apparent by mid-summer 1957 that only limited and temporary success could be hoped for through the application of passive camouflage to an aircraft of conventional structure. Briefly the reason is that (so far as known to the U. S. Government) all camouflage devices in use, under development, or even contemplated, in either the United States or Europe, are either too heavy or too bulky for aircraft application (except at prohibitive cost in performance) or are inherently narrow banded. At the same time, the Russian radar system is already characterized by a very considerable degree of frequency diversification which is rapidly increasing. Any feasible combination of narrow banded solutions can cover only two or three regions in the whole spectrum and can therefore give only limited protection.

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c. These circumstances suggest that only a much more radical approach offers the possibility of really satisfactory results. The objective must be to achieve inherently broad banded solutions, which would afford protection not only over all the ranges of frequencies in which Russian radar currently operates, but also against sets operating at new points on the spectrum. Preliminary consideration led to the conclusion that any such radical approach would involve the use of unconventional materials, or unconventional structures, or unconventional configurations of aircraft, or some combination of the three and would, therefore, inevitably require the design of an entirely new aircraft optimized with respect to radar reflectivity. Accordingly, an exploration of possible design approaches was set in motion in August 1957.

2. Study Now in Progress:

a. Unconventional materials, structures, and configurations all have a cost in terms of weight or drag, so any of the radical approaches now under consideration will involve a compromise between the invisibility of the aircraft and its performance. In the present state of knowledge a clear cut choice of the optimum approach is difficult and no one can be certain that even the best compromise will be worthwhile. The familiar techniques of reducing reflectivity are either too heavy and bulky or just not effective enough and the accurate evaluation of the reflectivity of complete aircraft is extraordinarily difficult. Accordingly, in its present phase, the study is focused on the "invention" of new approaches to the electronic objective and upon techniques of measurement and experiment designed to reveal the effectiveness of these approaches. At the same time, recent advances in the state of the art in aerodynamics must be reviewed in an effort to offset as far as possible the inevitable penalties to aircraft performance. In the next phase, it will be necessary, and it should be possible, to weigh the gains to be achieved in the form of reduced reflectivity by each approach against its aerodynamic costs and on this basis to select one (or at most two or three) as the most promising. Once the field has thus been narrowed, it will be possible for an aircraft manufacturer to develop a concrete proposal (or alternative proposals) for an aircraft which will achieve the best performance obtainable within the state of the art employing the approach that has been selected.

b. Especially in its present phase this is more a scientific than an engineering study, though the scientists must have access to competence in airframe design and in structures and materials for their guidance. Accordingly, a temporary technical staff for the Project has been assembled

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25X1 [redacted] The core of
the staff is the group of scientists [redacted] who
25X1 have been working on the RAINBOW Project for the last year. They will
be supplemented with two or three additional men in the field of electronics
and will be assisted by consultants from several other organizations,
25X1 [redacted] (on certain materials problems),
possibly the National Advisory Committee for Aeronautics, and firms on
the east and west coasts that are conducting both full-scale and model
tests under the direction of the technical staff. In addition, basic research
contracts have been concluded [redacted]

25X1 [redacted] Considerable effort has been and is being
expended to develop really reliable measurement techniques, including
25X1 a small range [redacted] for model tests of low frequency reflection,
25X1 a large outdoor range [redacted] for model tests of high frequency
25X1 reflection and equipment for full-scale testing (both ground and flight
tests) [redacted] Most of the personnel and facilities
thus assembled had already been employed in the RAINBOW program and
the work on the production of camouflage application to conventional
airframes is still proceeding.

c. Since the autumn of 1956 when it began to appear that the RAINBOW Project might achieve some degree of success, the Air Force and the Navy have been kept informed of its progress and have provided support. Knowledge of the activity has been closely held but has been available to a sufficient number of officers in each Service to insure that the implications of radar camouflage for Military programs could be taken into account. All of the arrangements described in the preceding paragraph were made in the first instance as the means of carrying out the original RAINBOW development of radar camouflage and are believed to be satisfactory to the Air Force and the Navy, at least in connection with that program. When emphasis was shifted to the above-described study of a more radical solution, a very few senior Air Force and Navy officers were so informed and are aware both of the character of the work in progress and of its purpose. The bulk of the work done in this country in aviation and electronics and of the competence available in the Government in these two fields is to be found in the Air Force and the Navy. Since the Central Intelligence Agency neither does nor should possess any parallel capability, the most intimate cooperation is required if the above-described program is to have a chance of success.

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3. Preliminary Conclusions:

a. Although, as stated above, it is too soon to judge the technical feasibility of an extremely low reflectivity reconnaissance aircraft, such a system, if feasible, would have notable advantages as a complement to a reconnaissance satellite. Operating at seventy to eighty thousand feet, extremely high resolution photography and excellent electronic intelligence is available. Since radar reflectivity would be exceptionally low in the X-band, the aircraft would have a high degree of immunity to both aircraft and missile interception. If not susceptible to more than sporadic detection and tracking, its immunity to interception would be further enhanced and the political obstacles in the way of its employment would be reduced to a minimum. In particular, it is believed that (if feasible) such a reconnaissance vehicle is more promising than a manned aircraft designed for greater performance but without benefit of radar camouflage. Although it would be entirely within the state of the art to build an aircraft with a ceiling of [REDACTED] it might well be subject to interception by ground-to-air missiles by the time it could be operational. In brief, it is submitted that any reconnaissance vehicle can achieve reasonable immunity from physical interception and political frustration only by going far higher than manned aircraft or achieving effective invisibility to radar.

b. If, on the basis of a favorable outcome to the study now in progress, the decision should be made to proceed with the reconnaissance system herein discussed, this project should be carried out with maximum speed and security. There is no slightest possibility that a successor aircraft could be operational sooner than the spring of 1959, yet by that date it seems highly likely both that the U-2 will be obsolete and that the urgency of the need for photographic reconnaissance will be even greater than it is today. The management and organization of this later phase of the project, if it is undertaken, should be chosen with these objectives in view.

c. An appreciable part of the possible benefit of the present study and of any project that grows out of it will be lost if the tightest security is not maintained around it. It must be emphasized that in the fields of radar and of passive and active countermeasures there are not likely to be a few crucial secrets, the safeguarding of which can protect the security of the whole system in which they are used. Most or all of what is known to us in these fields is known to the Russians and they are as capable as we of devising and understanding the design approaches

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now under study. The only way to achieve a decisive lead over their radar defense is to develop a system and have it operational before they have discovered that an intensive effort is being made in this area.

4. Proposed Course of Action:

25X1 a. The program of studies, measurement and experimentation will be carried forward with all possible speed, in conjunction with further work on the RAINBOW camouflage, looking toward the choice of a design approach for a possible new aircraft within three months' time. The work will be under the technical direction of the above-described scientific staff [redacted] with actual systems responsibility remaining in the AQUATONE Project Headquarters in Washington, D. C.

b. During this phase, contact will be made with certain manufacturers as appropriate in order to explore the possibilities of unconventional materials and structures and receive the benefit of their views on the general design problem.

c. It is proposed to maintain more continuous and more intimate contact than hitherto with appropriate components in the Air Force and the Navy.

d. Appropriate steps should be taken to control discussion with manufacturers in the aviation and electronics industries and actions such as the issuance of formal requirements which might stimulate unusual interest in the concept of a non-radar reflective aircraft.

e. As soon as it is possible to select the optimum design approach for a low reflectivity reconnaissance aircraft and to evaluate with reasonable reliability both its feasibility and its performance, a Governmental decision should be made as to the advisability of a crash program to produce eight to twelve such vehicles.

5. If the above-outlined conclusions and course of action are generally satisfactory, the joint report by the Secretary of Defense and the Director of Central Intelligence, although it should avoid any description of the concept and study herein discussed, could respond to this part of the Foreign Intelligence Board's recommendation with the statement (a) that one of the possible advanced reconnaissance systems known to the Board

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is being studied, (b) that for the present at least questions of funding and management are in hand, (c) that the study is proceeding with the utmost sense of urgency, and (d) that joint recommendations for action will be submitted if and when the feasibility of the system is established.

RMB:djm:gjg

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2-R. M. Bissell Subj cy (Pro. Dir)

3-Admiral Burke - USN ☐ retained)

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7-RAINBOW Chrono (SECURITY Offr) w/signed receipts

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